

The background features a vibrant, abstract design with colorful splatters and dust-like particles in shades of orange, red, pink, purple, and teal. A dark, semi-transparent rectangular box is centered horizontally, serving as a backdrop for the text.

SOUND, COLOR AND SCIENCE

CROSS-CURRICULAR EXPLORING USING YOUR IMAGINATION













Orion



WHAT ENVIRONMENT ARE WE TRYING TO CREATE?

- Imaginative
- Safe
- Explorative
- Musical
- Relatable
- Colorful
- Scientific

COLORADO STATE STANDARDS FOR MUSIC

- Music produces creativity, innovation, and cornerstone life skills that will be the key to opening doors for a more diverse and competitive workforce. In learning music, students use critical thinking, self assessment, reasoning, problem solving, and collaboration, and make connections in new and imaginative ways as they progress through their musical education. All of these skills prepare our students for higher education and the 21st-century workforce. These standards outline the knowledge and skills needed by all Colorado citizens to participate productively in an increasingly creative economy and innovative society.
- <https://www.cde.state.co.us/coarts/2020cas-mu-p12>





COMPARISON BETWEEN VISUAL ARTS AND MUSIC STANDARDS IN COLORADO

1. Expression of Music

The expression of music is the process of practice, refinement, and performance of acquired musical knowledge and skills to communicate a range of thoughts and emotions.

1. Observe and Learn to Comprehend
Artists make art from what they see, know and are curious about. As students create new artworks they synthesize interdisciplinary learning, social and cultural norms, personal narratives and the influences of visual culture. This standard includes research activities such as examination of details in the environment, noticing overlooked aspects of one's surroundings, telling stories before, during and after making art, and using academic and informal learning to form new ideas. It includes viewing and researching the work of artists to broaden perspectives.

2. Aesthetic Valuation of Music

The aesthetic valuation of music focuses on the knowledge and perspectives needed to make informed evaluations and critiques of music. It also addresses the historical, cultural, and societal contexts which are often the beauty, heart, and soul of music.

4. Relate and Connect to Transfer

Artists make new connections to their own environments, cultures, and stories through the process of making art. They integrate learning from various disciplines and philosophies, and formulate questions to study. Learning experiences include exploring creative careers, applying artistic processes to everyday challenges, studying and responding to historical and contemporary art, and applying interdisciplinary content.

CREATING, PERFORMING, AND CONNECTING THROUGH MUSIC

- Music Education is an aural art form that satisfies the human need to respond to life experiences through singing, listening, and/or playing an instrument
- Development of verbal and nonverbal communication skills
- Know and demonstrate how arts can communicate experiences, stories or emotions through the production of works of art
- Identify explain and analyze traditions as they relate to works in the arts
- Recognize that the environment of the observer influences individual aesthetic response to works in the arts.

SCIENCE

First Grade, Standard 3. Earth and Space Science



COLORADO
Department of Education

Prepared Graduates:

9. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding the universe and Earth's place in it.

Grade Level Expectation:

1. Patterns of movement of the sun, moon and stars as seen from Earth can be observed, described and predicted.

Evidence Outcomes

Students Can:

- Use observations of the sun, moon, and stars to describe patterns that can be predicted. (1-ESS1-1) *(Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky and set; and stars other than our sun are visible at night but not during the day.)*
- Make observations at different times of year to relate the amount of daylight to the time of year. (1-ESS1-2) *(Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.) (Boundary Statement: Limited to relative amounts of daylight, not quantifying the hours or time of daylight.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

- Plan and conduct investigations collaboratively to produce evidence to answer a question. (Planning and Carrying out Investigations) (Personal: Personal responsibility).
- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (Analyzing and Interpreting Data) (Entrepreneurial: Creativity/Innovation).

Elaboration on the GLE:

- Students can answer the questions: What is the universe, and what goes on in stars? (ES1.A) What are the predictable patterns caused by Earth's movement in the solar system? (ES1.B)
- ESS1:A The Universe and Its Stars: Patterns of the motion of the sun, moon and stars in the sky can be observed, described and predicted. At night one can see the light coming from many stars with the naked eye, but telescopes make it possible to see many more and to observe them and the moon and planets in greater detail.
- ESS1:B Earth and the Solar System: Seasonal patterns of sunrise and sunset can be observed, described and predicted.

Cross Cutting Concepts:

- Patterns: Patterns in the natural world can be observed, used to describe phenomena and used as evidence.
- Scientific Knowledge Assumes an Order and Consistency in Natural Systems: Science assumes natural events happen today as they happened in the past.

The background is a dark blue gradient with faint, light blue geometric patterns. On the left side, there is a large circular scale with tick marks and numbers ranging from 140 to 260. Several concentric circles and dashed lines with arrows are scattered across the background, creating a sense of motion and geometry.

LET'S SPEAK ABOUT THE SCIENCE OF MUSIC

**"THERE IS GEOMETRY IN THE HUMMING OF THE STRINGS, THERE IS
MUSIC IN THE SPACING OF THE SPHERES"**

MUSIC ON VOYAGER 1 AND 2

- Bach, Brandenburg Concerto No. 2 in F. First Movement, Munich Bach Orchestra, Karl Richter, conductor. 4:40
- Java, court gamelan, "Kinds of Flowers," recorded by Robert Brown. 4:43
 - Senegal, percussion, recorded by Charles Duvelle. 2:08
- Zaire, Pygmy girls' initiation song, recorded by Colin Turnbull. 0:56
- Australia, Aborigine songs, "Morning Star" and "Devil Bird," recorded by Sandra LeBrun Holmes. 1:26
- Mexico, "El Cascabel," performed by Lorenzo Barcelata and the Mariachi México. 3:14
 - "Johnny B. Goode," written and performed by Chuck Berry. 2:38
- New Guinea, men's house song, recorded by Robert MacLennan. 1:20
- Japan, shakuhachi, "Tsuru No Sugomori" ("Crane's Nest,") performed by Goro Yamaguchi. 4:51
- Bach, "Gavotte en rondeaux" from the Partita No. 3 in E major for Violin, performed by Arthur Grumiaux. 2:55
- Mozart, The Magic Flute, Queen of the Night aria, no. 14. Edda Moser, soprano. Bavarian State Opera, Munich, Wolfgang Sawallisch, conductor. 2:55
- Georgian S.S.R., chorus, "Tchakrulo," collected by Radio Moscow. 2:18
- Peru, panpipes and drum, collected by Casa de la Cultura, Lima. 0:52
- "Melancholy Blues," performed by Louis Armstrong and his Hot Seven. 3:05
- Azerbaijan S.S.R., bagpipes, recorded by Radio Moscow. 2:30
- Stravinsky, Rite of Spring, Sacrificial Dance, Columbia Symphony Orchestra, Igor Stravinsky, conductor. 4:35
- Bach, The Well-Tempered Clavier, Book 2, Prelude and Fugue in C, No.1. Glenn Gould, piano. 4:48
- Beethoven, Fifth Symphony, First Movement, the Philharmonia Orchestra, Otto Klemperer, conductor. 7:20
 - Bulgaria, "Izlel je Delyo Hagdutin," sung by Valya Balkanska. 4:59
 - Navajo Indians, Night Chant, recorded by Willard Rhodes. 0:57
- Holborne, Paueans, Galliards, Almains and Other Short Aeirs, "The Fairie Round," performed by David Munrow and the Early Music Consort of London. 1:17
- Solomon Islands, panpipes, collected by the Solomon Islands Broadcasting Service. 1:12
 - Peru, wedding song, recorded by John Cohen. 0:38
- China, ch'in, "Flowing Streams," performed by Kuan P'ing-hu. 7:37
- India, raga, "Jaat Kahan Ho," sung by Surshri Kesar Bai Kerkar. 3:30
- "Dark Was the Night," written and performed by Blind Willie Johnson. 3:15
- Beethoven, String Quartet No. 13 in B flat, Opus 130, Cavatina, performed by Budapest String Quartet. 6:37

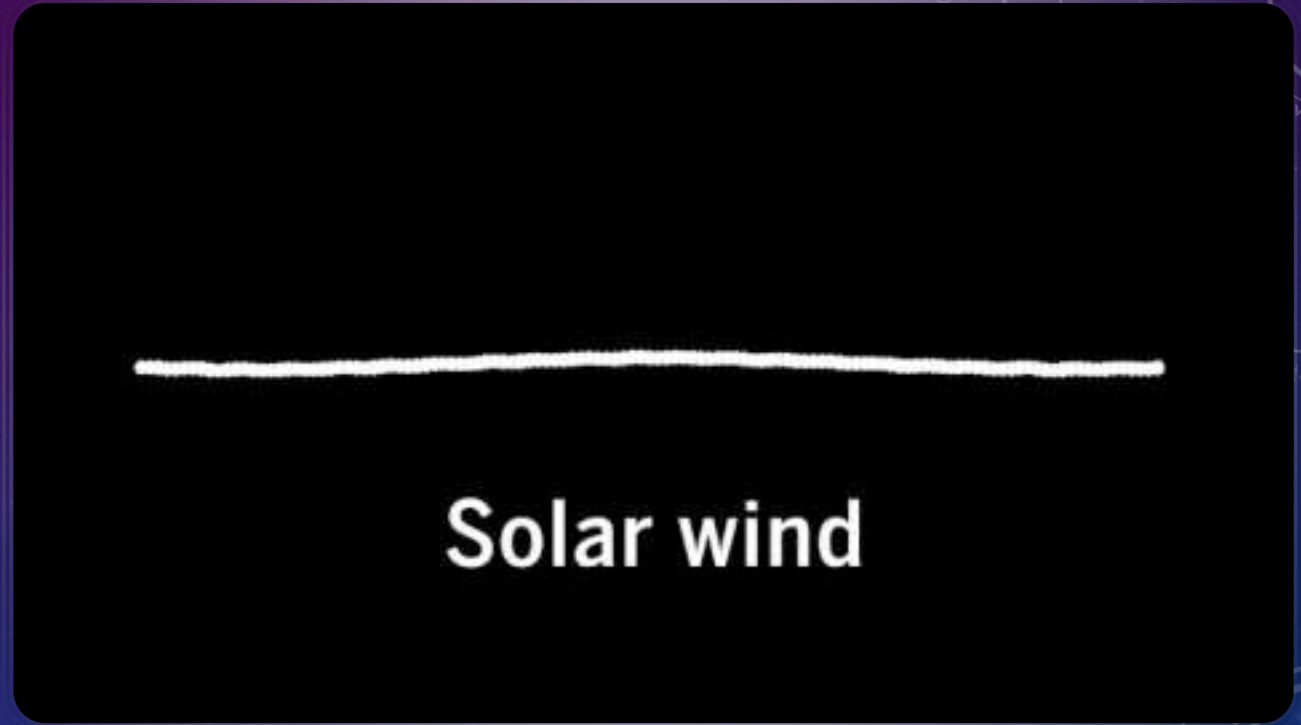
RHYTHM IS PITCH

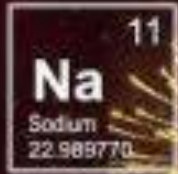
- What is sound?
- “Well-defined units combine to form highly complex and varied patterns.”
- Harmonic Series



WHAT DOES THE SOLAR WIND SOUND LIKE ?

- <https://www.youtube.com/watch?v=VPo4iOZRkls>



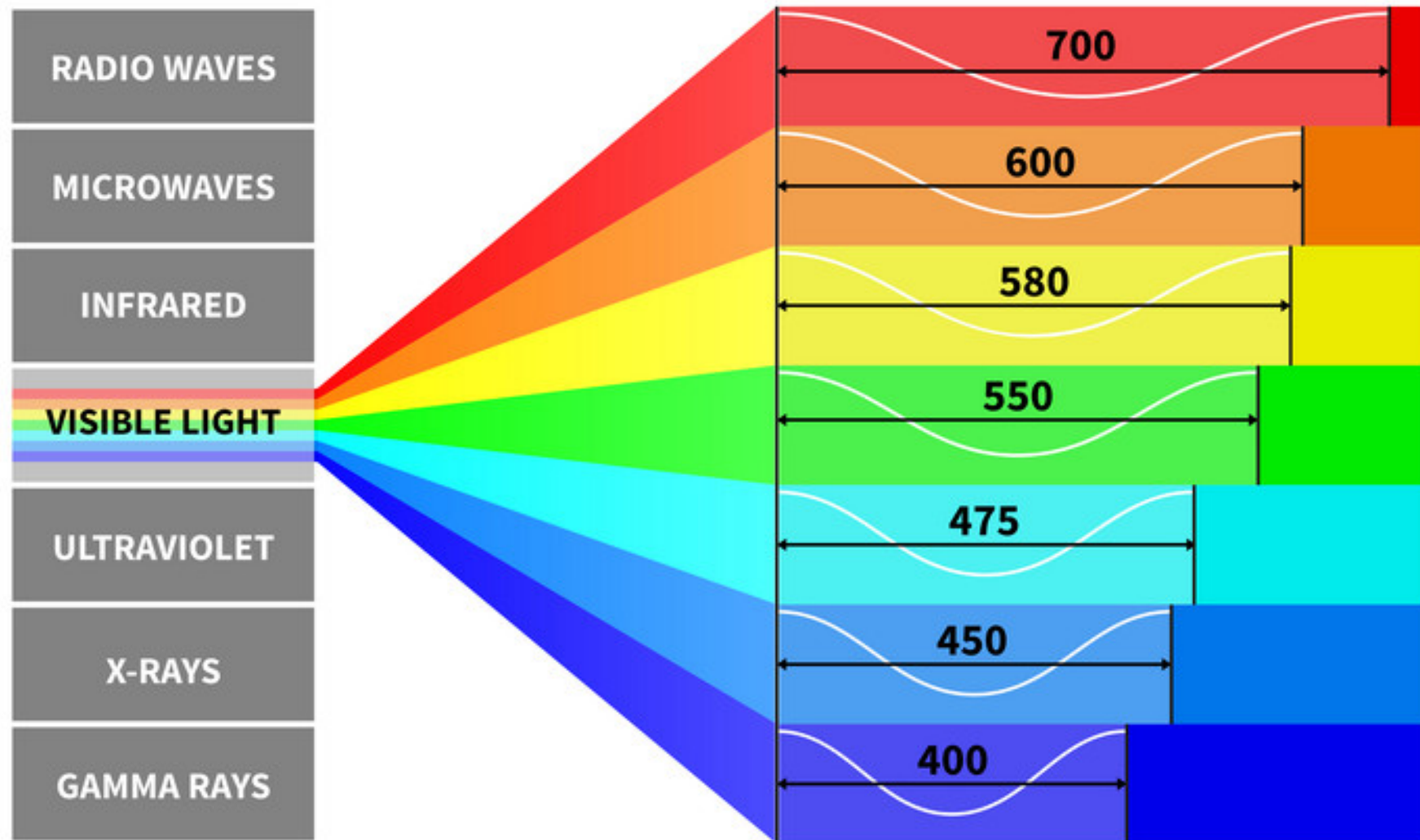


SCIENCE OF COLOR IN THE COSMOS

- Chemical Make Up
- Apparent vs Intrinsic Brightness
- Doppler Effect
 - Galaxies far away tend to be darker reds in color
 - an increase (or decrease) in the frequency of sound, light, or other waves as the source and observer move toward (or away from) each other. The effect causes the sudden change in pitch noticeable in a passing siren, as well as the redshift seen by astronomers.

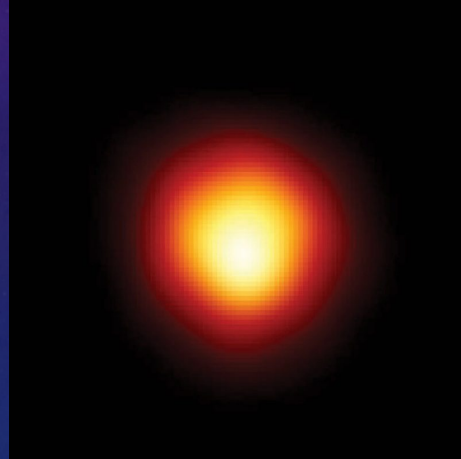


A spectrum of air. The bright bands are due to molecular oxygen (O_2), molecular nitrogen (N_2), and other molecules.





Our Sun produces more yellow light than any other color because its surface temperature is $5,500^{\circ}\text{C}$. If the Sun's surface were cooler—say $3,000^{\circ}\text{C}$ —it would look reddish, like the star Betelgeuse. If the Sun were hotter—say, $12,000^{\circ}\text{C}$ —it would look blue, like the star Rigel. https://science.nasa.gov/ems/09_visiblelight





The background is a gradient from dark purple at the top to deep blue at the bottom, speckled with small white dots. On the left side, there are several concentric circles and a large arc with a scale. The scale has markings from 140 to 260 in increments of 10. There are also smaller circles with arrows indicating clockwise or counter-clockwise rotation.

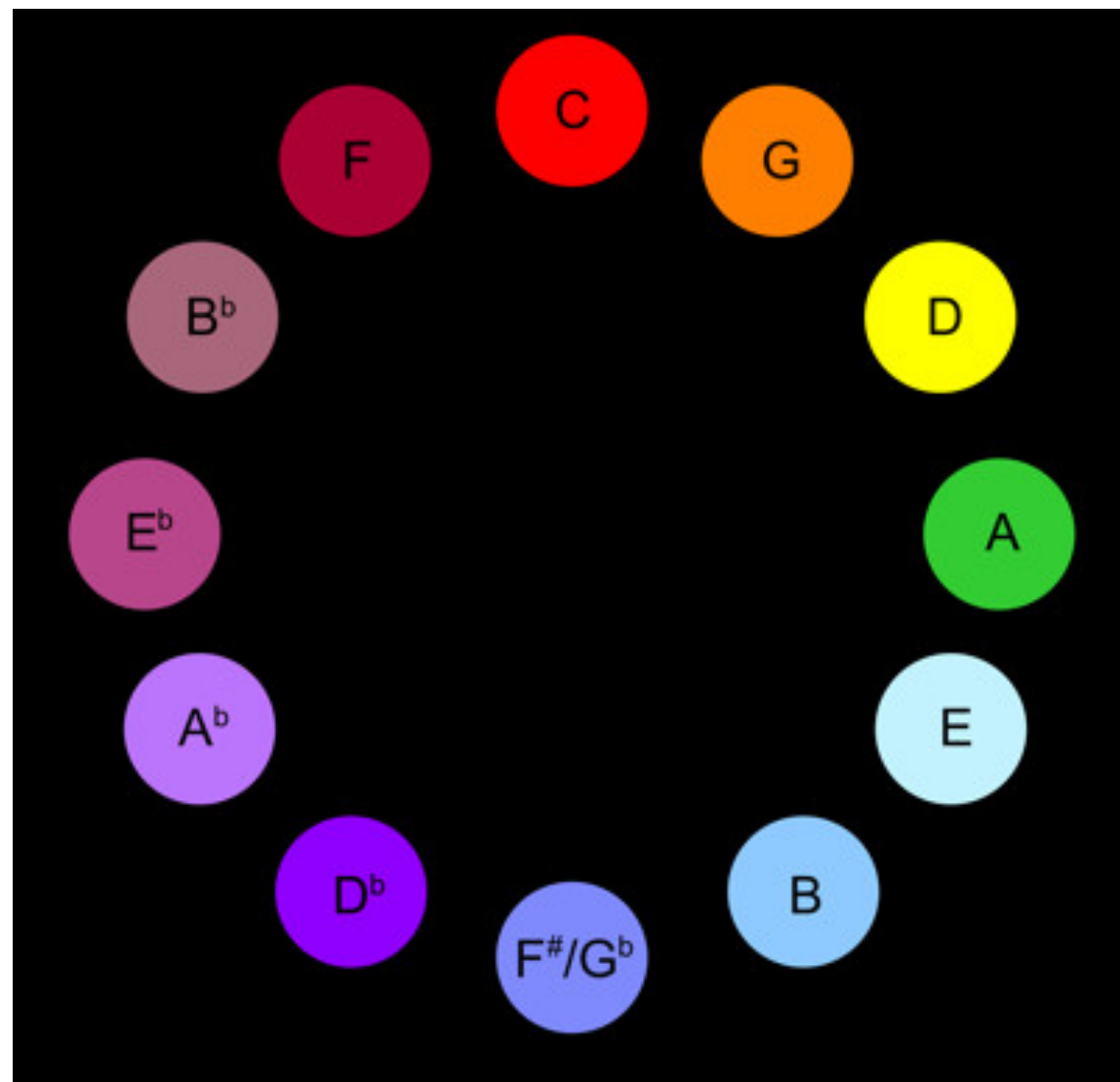
BIRD SONGS AND THE SOUND OF WINTER

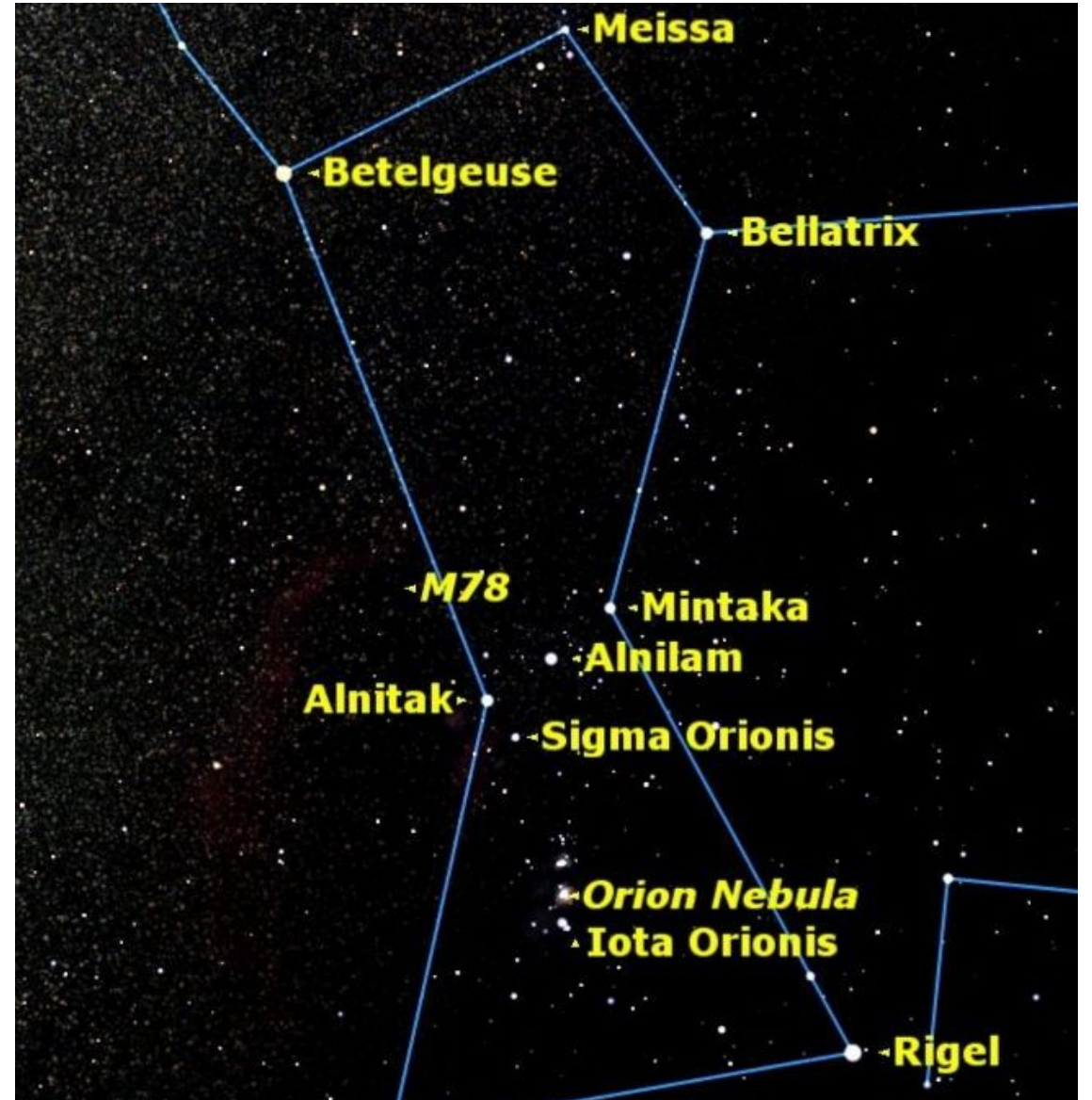


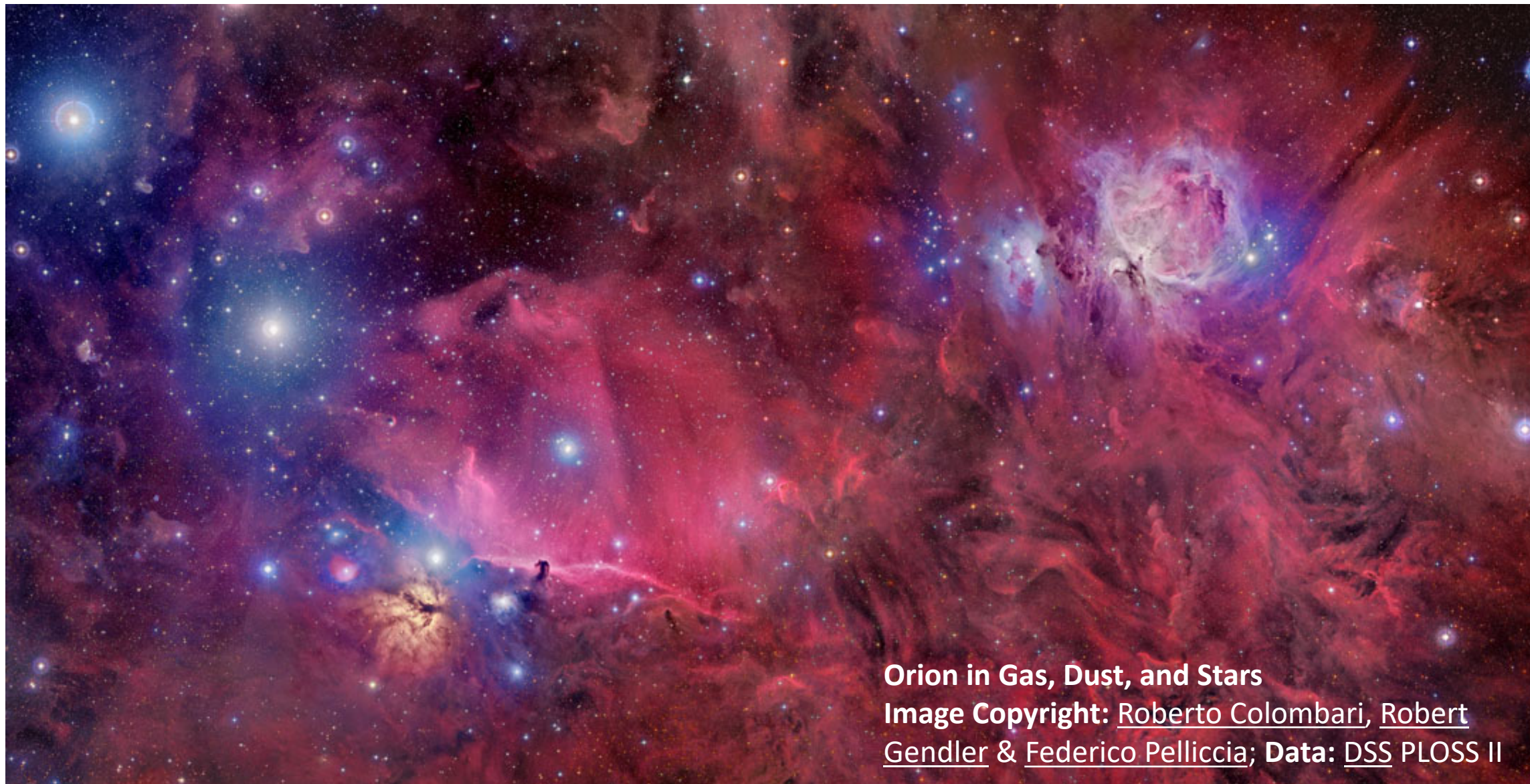
"Sweetie" Minor 3rd

HOW DO WE DEFINE PITCH IN RELATION TO COLOR

- Alexander Scriabin (1871–1915) developed a mapping between discreet pitches and discreet colors based on his experience with synesthesia, a condition that causes one sense to be perceived as a different sense. Scriabin perceived sound as color, and developed a mapping system called “clavier à lumière” (literally “keyboard with lights”) shown at the right.
- Rather than a pattern that placed similar colors on adjacent keys, Scriabin's system (and, presumably, his system of perception) placed similar colors on notes that were a perfect fourth and a perfect fifth apart. So, when the notes are laid out in the manner of a Circle of Fifths, the colors appear to be more systematic and continuous: (https://www.flutopedia.com/sound_color.htm)



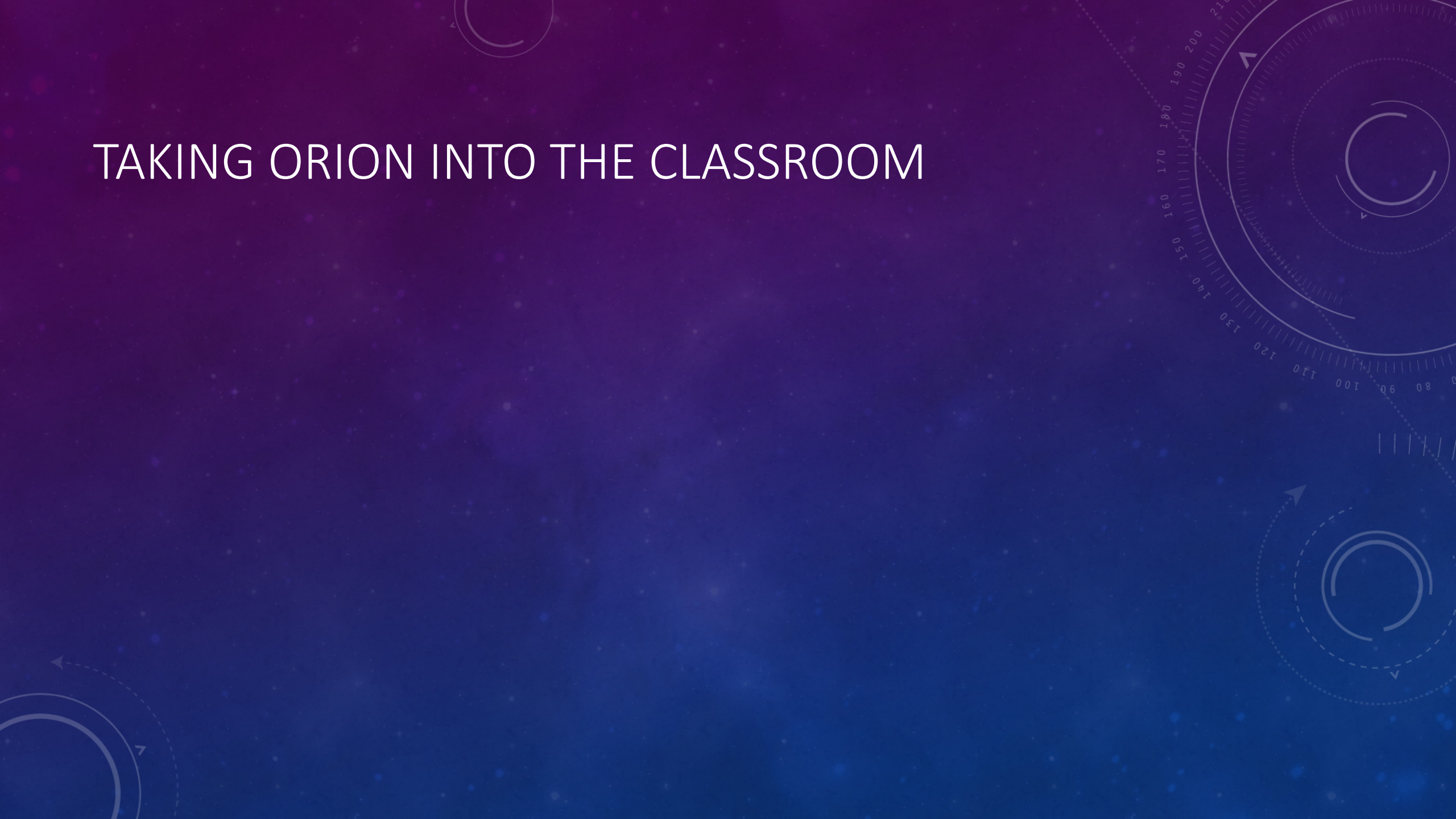




Orion in Gas, Dust, and Stars

Image Copyright: Roberto Colombari, Robert Gendler & Federico Pelliccia; **Data:** DSS PLOSS II

TAKING ORION INTO THE CLASSROOM





We focused on warm vs cool color mixing and experimentation and the dancing stars. The kids were excited to make their own interpretations of dancing stars and use their brush strokes to create rhythm and movement.

Class 1: Story, discussion, paint cool colored background

Class 2: Create painted paper for the stars with warm color paints

Class 3: Draw star shapes on warm-colored painted paper and cut out. Paste onto painted background from Class 1.

Grade 1 -3 View Out My Window

Class 1: Story, discussion, brief science aspects/exploring images of Orion constellation preliminary drawing

Class 2: Further elaborate on the science and exploring constellation. Develop drawing and add details. Discussion of what they see outside at night. Leading questions for them to consider. Have they ever really looked at their surroundings in the evening? What do you see, what do you hear? How do you feel? Translate this into their creations in a visual manner. Colored pencils and crayon.

Class 3: Finish drawn and colored details. Oil pastel and watercolor for night sky.

Draw what they see from their bedroom window. Option to include themselves in the picture.

WHAT COLORS DO THEY SEE?

- Dark purple
- Sapphire blue
- Dark Blue
- Magenta
- Violet
- Maroon





WHAT SOUNDS DO THEY HEAR ?

- Croaking -tuba, trumpet, violin
- Frogs – cello, violin
- Birds- flute, whistle, clarinet
- Crickets – violin, cello
- Bugs buzzing – maraca, shaker
- Traffic passing by – horns, violin, shaker
- Fan/air conditioner – picking at a guitar, boom whacker
- Rain -sound from rainstick, tambourine, chimes
- Thunder – sound of drums, cymbals





HOW ART AND SCIENCE CAN FIND A PLACE IN THE MUSIC CLASSROOM

- Sound Story
- Musical
Autobiography

ORION LESSON PLAN



Read the book *Orion's Symphony* by
Diana Traietta and Illustrated by
Danielle Zito



Orion is a real constellation
(<https://www.space.com/16659-constellation-orion.html>) FREE
Resource

Questions to ask and reflect on after reading
the book

- What is a constellation?
- How do we locate the constellation Orion?
(<http://www.skymaps.com>) This website has
a great star map that is free to use and is
updated depending on the month- FREE
Resource
- Can they identify the three stars of the
"belt"? (<https://www.space.com/13924-orion-constellation-nebula-skywatching-tips.html>) This is where little Orion went on
his adventure.
- What colors do you see in the night sky? It's
not black as most children would respond, its
actually full of colors depending on the
chemical makeup of the gases.
- Here is a picture of all the colors from the
belt of Orion
(<https://apod.nasa.gov/apod/ap171123.html>
) on a side note Astronomy Picture of the Day
gives you a new incredible astronomy picture
each day



What do you see when you look
outside your window of the night
sky?

Have the student draw their view of the night
sky, depending on where and how they live
this is an amazing insight into their life

- What did Orion see outside his window?
- What colors are used to represent the
change from dusk through sunrise?



What sounds to you hear in the
night sky?

Ask the student what sounds they hear at
night.

Can they describe the sounds that they hear in
relation to a instrument? What instrument?
What are the timbres do they hear

Different pitches can also be described using
colors through the vibrations of each note.

Can they describe what pitches are being
expressed through the story based on the
following?

HOW I INTERPRET THE NIGHT SKY









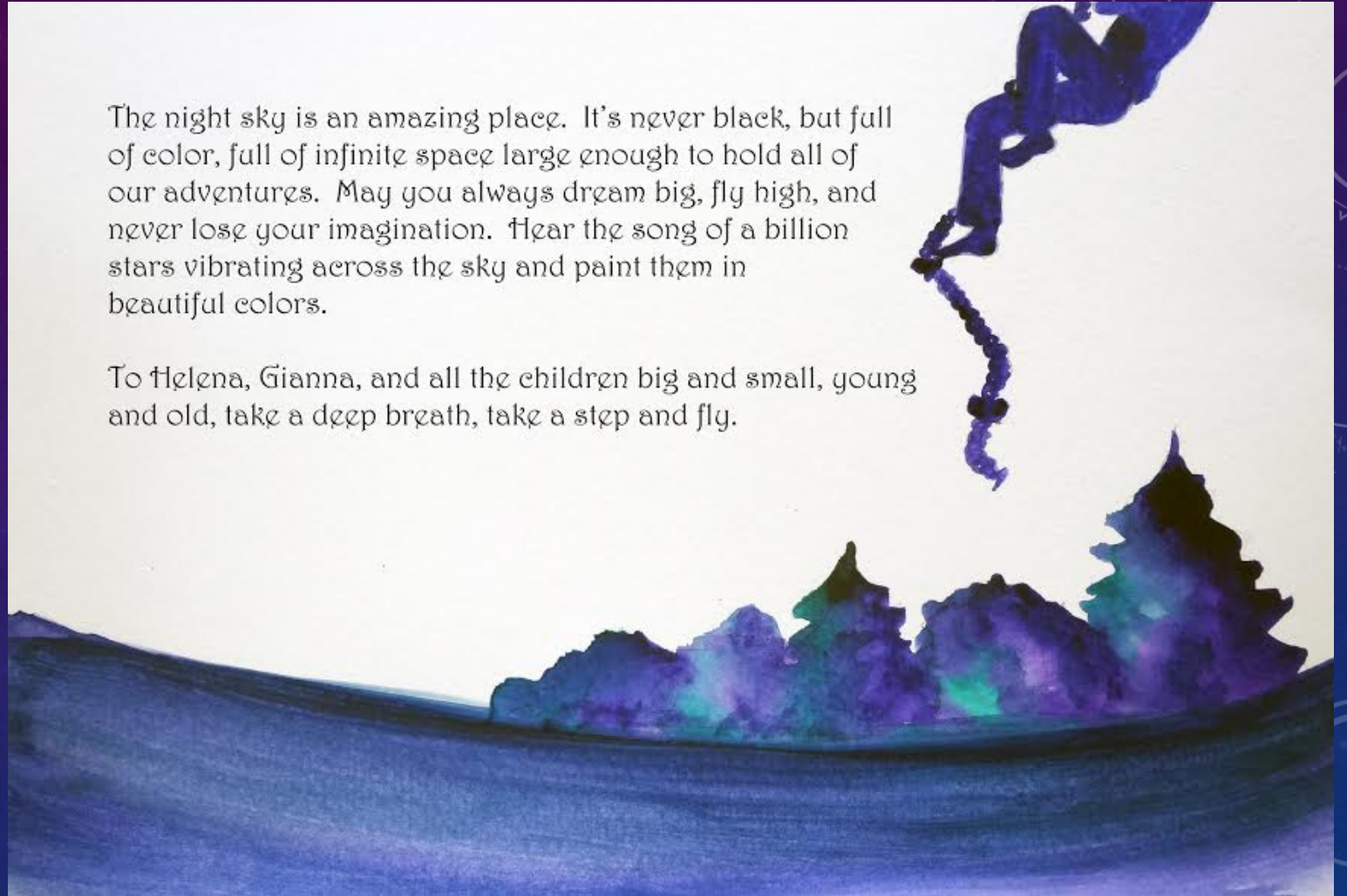


LOOKING UP AND THE NIGHT SKY, WHAT DO YOU SEE?

- Special Thank You to others that have contributed to this project
- Mrs. Danielle Zito, Delaware Valley Elementary School, Matamoras, PA . Grades K -3
- Pitch is Rhythm Video used with special permission of Dr. Matt Russo, PhD and Alexander Chen

The night sky is an amazing place. It's never black, but full of color, full of infinite space large enough to hold all of our adventures. May you always dream big, fly high, and never lose your imagination. Hear the song of a billion stars vibrating across the sky and paint them in beautiful colors.

To Helena, Gianna, and all the children big and small, young and old, take a deep breath, take a step and fly.



<https://excelciamusic.com/diana-traietta-cmea-clinic/>